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| Applicant's or agent's file reference CQD 2569 WO | | FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416) | |
| International application No. PCT/EP 03/09709 | International filing date (day/month/year) 02.09.2003 | Priority date (day/month/year) 06.09.2002 | |
| International Patent Classification (IPC) or both national classification and IPC F41H5/04 | | | |
| Applicant TEIJIN TWARON GMBH | | | |
| <p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 5 sheets.</p> | | | |
| <p>3. This report contains indications relating to the following items:</p> <p>I <input checked="" type="checkbox"/> Basis of the opinion</p> <p>II <input type="checkbox"/> Priority</p> <p>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p>IV <input type="checkbox"/> Lack of unity of invention</p> <p>V <input checked="" type="checkbox"/> Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p>VI <input type="checkbox"/> Certain documents cited</p> <p>VII <input type="checkbox"/> Certain defects in the international application</p> <p>VIII <input type="checkbox"/> Certain observations on the international application</p> | | | |
| Date of submission of the demand 05.02.2004 | | Date of completion of this report 13.12.2004 | |
| Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016 | | Authorized Officer Pussemier, B Telephone No. +31 70 340-4562  | |

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. **PCT/EP 03/09709**

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, Pages

1, 5-10 as originally filed
2, 3, 4 received on 09.08.2004 with letter of 04.08.2004

Claims, Numbers

9-23 as originally filed
1-8 received on 09.08.2004 with letter of 04.08.2004

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
☐ the language of publication of the international application (under Rule 48.3(b)).
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
☐ filed together with the international application in computer readable form.
☐ furnished subsequently to this Authority in written form.
☐ furnished subsequently to this Authority in computer readable form.
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

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6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement**

1. Statement

| | | |
|-------------------------------|-------------|------|
| Novelty (N) | Yes: Claims | 1-23 |
| | No: Claims | |
| Inventive step (IS) | Yes: Claims | |
| | No: Claims | 1-23 |
| Industrial applicability (IA) | Yes: Claims | 1-23 |
| | No: Claims | |

2. Citations and explanations

see separate sheet

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EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/EP 03/09709

Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:

- D1: WO 00 42246 A (DORLOFF LUMPE BAERBEL ;FELS ACHIM (DE);
BAUMGART CHRISTOPH (DE); B) 20 July 2000 (2000-07-20) cited in the
application
- D2: DATABASE EPODOC [EUROPEAN PATENT OFFICE, THE HAGUE, NL;
XP002231 859 & KR 9401 038 B (KOLON INC) 8 February 1994(1994-02-08)
- D3: US-A-6 034 004 (FELS ACHIM ET AL) 7 March 2000 (2000-03-07)
- D4: US-A-S 556 695 (MAZELSKY BERNARD) 17 September 1996 (1996-09-17)
- D5: US-A-S 344 956 (ALLEWAERT KATHY ET AL) 6 September 1994
(1994-09-06)
- D6: US-A-4 608 717 (DUNBAVAND IAN E) 2 September 1986 (1986-09-02)

- 1.1 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 1-23 does not involve an inventive step in the sense of Article 33(3) PCT. The reasons being as follows:
- 1.2 The document D1 is regarded as being the closest prior art to the subject-matter of claim 1, and discloses in the wording of claim 1 (see D1, page 1 line 30- page 2 line 20; page 5 lines 8-31; claim 1): a penetration-resistant material comprising a double layer of woven fabric wherein the double layer comprises a first layer of fabric composed of a first set of threads comprising 3.5 to 20 threads/cm, having a linear density of at least 210 dtex, and comprising at least 65 % of the fabric weight. and a second set of threads comprising 0.5 to 16 threads/cm and having a linear density of at least 50 dtex, with the second set of threads being transverse to the first set of threads, and the ratio of the number of threads/cm of the first set to that of the second set is > 1 , and a second layer of fabric composed of a first set of threads comprising 0.5 to 16 threads/cm and having a linear density of at least 50 dtex, and a second set of threads comprising 3.5 to 20 threads/cm, having a linear density of at least 210 dtex, and comprising at least 65 % of the fabric weight, with the second set of threads being transverse to the first set of threads, and the ratio of the number of threads/cm of the second set to that of the first set is > 1 , and wherein the first and

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second sets of threads of the first layer have a parallel orientation (see D1, page 4 lines 15-16 "An angle of about 90° is most preferred.") towards the first and second sets, respectively, of threads of the second layer.

- 1.3 The applicant has argued that D1 does not disclose making the penetration-resistant material from two different types of fabric which are not cross-ply at an angle. However, this is not reflected in claim 1, as claim 1 addresses the fabric characterized by its composition and not the method of making the fabric. Therefore, D1 does disclose a penetration-resistant material with the technical features of claim 1 partially as in the above paragraph 1.2.
- 1.4 The subject-matter of claim 1 therefore differs from this known penetration-resistant material in that in the first layer of fabric at least the first set of threads and in the second layer of fabric at least the second set of threads are treated with a water-repellant.
- 1.5 The problem to be solved by the present invention may therefore be regarded as providing a penetration-resistant material which avoids a high uptake of water, as this results in a decrease of ballistic performance.
- 1.6 The solution proposed in claim 1 of the present application cannot be considered as involving an inventive step (Article 33(3) PCT) for the following reasons:
- 1.7 The treatment of penetration-resistant materials with a water repellent is described in document D2 as providing the same advantages as in the present application. The skilled person would therefore regard it as a normal design to include this feature in the penetration-resistant material described in document D1 in order to solve the problem posed.
Furthermore, the treatment of penetration-resistant materials with a water repellent is commonly known from e.g. D3, D4 and D6, whereby D3 (see column 3, lines 47-51) explicitly states that "In order to also ensure good antiballistic action in the wet state or after water accumulation, it is common in many cases to subject the aramide-fiber fabrics to a water-repellent treatment, ...". Therefore also the combination of D1 with each of the documents D3, D4 and D6 would lead the skilled person in an obvious manner to the subject-matter of claim 1.

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- 1.8 The applicant has argued that treating the threads with a water-repellant before weaving is not disclosed in D2. However, this is also not addressed in claim 1. Claim 1 mentions that in the first layer of fabric at least the first set of threads and in the second layer of fabric at least the second set of threads are treated with a water-repellant. By treating the woven fabric with a water-repellant, all sets of threads are treated with the water-repellant, including the in claim 1 mentioned sets.
- 1.9 Furthermore, also treating the threads before weaving, in order to solve the same problem (as mentioned in the above paragraph 1.5), is known from the state of the art, as D4 discloses (see column 4, lines 10-12) that water-repellant treatment can be done by either the manufacturer of the thread, or the weaver of the fabric.
- 2.1 As D1 also discloses the technical features of claims 2, 6-20, 22 and 23, the subject-matter of these claims does also not involve an inventive step.
- 2.2 The technical features of claims 3-5 only concern a choice of known water repellants, as known from e.g. D3, D5 Therefore, the subject-matter of these claims does also not involve an inventive step.
- 2.3 The technical features of claim 21 are one of the straight forward possibilities inherent to the production of a double layer fabric, which is known in the state of the art, as stated on page 8, line 6.

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In WO 00/42246 a penetration-resistant material is disclosed comprising at least a double layer of fabric composed of two layers of woven fabric which are cross-plied at an angle wherein the fabric is composed of a first set of threads comprising 3.5 to 20 threads/cm and having a linear density of at least 420 dtex, and a second set of threads comprising 0.5 to 8 threads/cm and having a linear density of at least 50 dtex, with the second set of threads being transverse to the first set of threads and wherein the ratio of the linear density of the first set of threads to the linear density of the second set of threads is > 4.2 , more preferably > 7.5 . In a preferred embodiment the first set of threads is warp threads made of p-aramid yarn and the second set of threads is weft threads made of polyester yarn, and the ratio of the number of threads/cm of the first set to that of the second set is > 1 . Although the ballistic performance of this material is excellent, the necessity of cross-plying the layers is a disadvantage in terms of ease and simplicity of the manufacture and the danger of creating weak points that inherently to the process of cross-plying can occur.

So, the problem underlying the present invention is to provide a penetration-resistant material which does not exhibit the disadvantages of the prior art.

Some penetration-resistant materials exhibit a high uptake of water resulting in a decrease of ballistic performance. Therefore, another problem underlying the present invention is to reduce this drawback.

These problems are solved by a penetration-resistant material comprising at least a double layer of woven fabric wherein the double layer comprises a first layer of fabric composed of a first set of threads comprising 3.5 to 20 threads/cm, having a linear density of at least 210 dtex, and comprising at least 65 % of the fabric weight, and a second set of threads comprising 0.5 to 16 threads/cm and having a linear density of at least 50 dtex, with the second set of threads being transverse to the first set of threads, and the ratio of the number of threads/cm of the first set to that of the second set is > 1 , and a second layer of fabric composed of a first set of threads comprising 0.5 to 16 threads/cm and having a linear density of at least 50 dtex, and a se-

second set of threads comprising 3.5 to 20 threads/cm, having a linear density of at least 210 dtex, and comprising at least 65 % of the fabric weight, with the second set of threads being transverse to the first set of threads, and the ratio of the number of threads/cm of the second set to that of the first set is > 1 , and wherein the first and second sets of threads of the first layer have a parallel orientation towards the first and second sets, respectively, of threads of the second layer, which penetration-resistant material is characterized in that in the first layer of fabric at least the first set of threads and in the second layer of fabric at least the second set of threads are treated with a water-repellant.

Within the scope of the present invention the term „thread“ means any sort of thread such as staple yarn, twisted staple yarn, twisted filament yarn, non-twisted intermingled yarn, and preferably, untwisted filament yarn.

In a preferred embodiment of the penetration-resistant material according to the present invention in the first layer of fabric the first and the second set of threads and in the second layer of fabric the first and the second set of threads are treated with a water-repellant.

Within the scope of the present invention in principle any substance which repels water and which can be applied to the threads with known methods can be used as the water-repellant. However, because of its high water-repellant efficiency a water-repellant comprising fluor and carbon atoms, e.g. a fluoropolymer, and especially a mixture of fluoroacrylate polymers, is preferred. Said mixture is for example contained in OLEOPHOBOL SM[®] from Ciba Spezialitätenchemie Pferssee GmbH, Langweid am Lech, DE.

In a preferred embodiment of the penetration-resistant material according to the present invention the water-repellant treated threads comprise about 0.1 to about 2 weight % fluoroacrylate polymers with respect to the weight of the water-repellant

treated threads. Especially preferred is about 1 weight % fluoroacrylate polymers with respect to the weight of the water-repellant treated threads.

Preferably, in the penetration-resistant material according to the present invention at least the ratio of the linear density of the first set of threads to the linear density of the second set of threads of the first layer and of the linear density of the second set of threads to the linear density of the first set of threads of the second layer is > 1 , more preferably > 4.2 and most preferably > 5.9 . A particular effective ratio is 6 - 6.6.

In a preferred embodiment of the penetration-resistant material according to the present invention at least one of the second set of threads of the first layer and the first set of threads of the second layer comprises 0.5 to 8 threads/cm.

In each layer the threads having a linear density of at least 210 dtex comprise at least 65 % of the fabric weight of that layer. Preferably, these threads comprise at least 70 % and more preferably 75 % of the fabric weight of that layer.

The second set of threads is transverse to the first set of threads in each of the two layers. Usually these sets are about perpendicular to each another, but this is not necessary. The second set of threads may be provided under an angle other than 90° to the first set of threads. The two layers are secured together without cross-plying.

In a preferred embodiment of the penetration-resistant material according to the present invention the threads of the layers of the double layer are bonded together, for instance, by stitch bonding, or preferably with an adhesive material. The adhesive material may be adhesive material provided onto the threads or onto the fabric, for instance as a finish.

The adhesive material can also be an adhesive layer provided between the two fabric layers of the double layer.

Penetration-resistant material and articles made of the same

Claims:

1. A penetration-resistant material comprising at least a double layer of woven fabric wherein the double layer comprises a first layer of fabric composed of a first set of threads comprising 3.5 to 20 threads/cm, having a linear density of at least 210 dtex, and comprising at least 65 % of the fabric weight, and a second set of threads comprising 0.5 to 16 threads/cm and having a linear density of at least 50 dtex, with the second set of threads being transverse to the first set of threads, and the ratio of the number of threads/cm of the first set to that of the second set is > 1 , and a second layer of fabric composed of a first set of threads comprising 0.5 to 16 threads/cm and having a linear density of at least 50 dtex, and a second set of threads comprising 3.5 to 20 threads/cm, having a linear density of at least 210 dtex, and comprising at least 65 % of the fabric weight, with the second set of threads being transverse to the first set of threads, and the ratio of the number of threads/cm of the second set to that of the first set is > 1 , and wherein the first and second sets of threads of the first layer have a parallel orientation towards the first and second sets, respectively, of threads of the second layer, and wherein in the first layer of fabric at least the first set of threads and in the second layer of fabric at least the second set of threads are treated with a water-repellant.

2. The penetration-resistant material of claim 1 wherein in the first layer of fabric the first and the second set of threads and in the second layer of fabric the first and the second set of threads are treated with a water-repellant.
3. The penetration-resistant material of claim 1 or 2 wherein the water-repellant comprises fluor and carbon atoms.
4. The penetration-resistant material of claim 3 wherein the water-repellant comprises a mixture of fluoroacrylate polymers.
5. The penetration-resistant material of any one of claims 1 to 4 wherein the water-repellant treated threads comprise about 0.1 to about 2 weight % fluoroacrylate polymers with respect to the weight of the water-repellant treated threads.
6. The penetration-resistant material of any one of claims 1 to 5 wherein at least the ratio of the linear density of the first set of threads to the linear density of the second set of threads of the first layer and of the linear density of the second set of threads to the linear density of the first set of threads of the second layer is > 1 .
7. The penetration-resistant material of claim 6 wherein at least the ratio of the linear density of the first set of threads to the linear density of the second set of threads of the first layer and of the linear density of the second set of threads to the linear density of the first set of threads of the second layer is > 4.2 .
8. The penetration-resistant material of claim 6 or 7 wherein at least the ratio of the linear density of the first set of threads to the linear density of the second set of threads of the first layer and of the linear density of the second set of threads to the linear density of the first set of threads of the second layer is > 5.9 .